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9 July 2011

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ISBN: [978-1-86435-644-1]; Full paper

ACHIEVING HIGH PERFORMING SUPPLY NETWORKS THROUGH VALUE NETWORK TRANSPARENCY

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Abstract

Supplier value networks are an emerging inter-organizational form resulting from efforts to integrate across fragmented supply chains, for the purpose of efficiency and performance gains. By proposing value network transparency as a central construct in supplier value networks, this paper identifies the different dimensions of transparency and presents a theoretical framework for achieving value network transparency through suitable governance mechanisms in the network. Using relational governance as the overarching theoretical perspective, arguments are presented for how certain governance mechanisms can act as motivators of value network transparency, while other act as facilitators of value network transparency. The performance implications of such value network transparency for the network as a whole and for individual firms within the network is postulated, and the affect of contingent factors such as the product type on the relationship between value network transparency and performance is discussed.

Keywords: Supply Networks, Value Network Transparency, Information sharing, Relational governance, Supply Chain Management

Acknowledgement: This research is supported in part by National University of Singapore URC Grant No. R-253-000-065-112, and by CLVBA@TUM – a project sponsored by SAP AG, and the European SAP University Alliances programme.

1 INTRODUCTION

Rapidly changing, complex and competitive business environments call for organizations to compete not just based on their own competencies, but through the formation of inter-organizational alliances and linkages with multiple business partners. Such inter-organizational linkages have been labelled using various terms such as strategic alliances (Ohmae 1989; Hamel 1991; Mowery et al. 1996), value chains, value shops and value networks (Norman & Ramirez 1993; Stabell & Fjelstad 1998) and supply networks (Samaddar et al. 2006).

Supplier value networks[1] are inter-organizational structures that enable the flow of physical goods, information, financial resources and knowledge between multiple linked organizations for the design and development of products and services to satisfy end-user requirements (Rai and Bush 2007). Such value networks represent a collection of upstream suppliers, downstream channels to market, and ancillary providers that support a common business model within an industry (Christensen 1997). They are formed by consolidating and integrating across fragmented supply chains. While supply chains are pre-dominantly vertically organized linkages among organizations designed for sourcing raw materials, value networks incorporate both vertical as well as horizontal inter-organizational linkages with the purpose of providing a complete solution to the customer.

Inter-organizational networks can be observed in various industries such as the personal computer industry (Magretta 1998), in the semi-conductor industry (Saxenian 1990; Rowley et al. 2000), the automotive industry (Dyer & Nobeoka 2000) and among biotechnology firms (Baum et al. 2000). Irrespective of the industry or end product that a value network caters to, they are formed with the expectation of higher benefits and increased efficiency (Oliver 1990) and are believed to have the highest value creating potential for end customers as well as the member organizations (Rai & Bush 2007). Therefore, value appropriation in the form of enhanced network capital, competitive and strategic benefits and performance gains is a primary concern among the various member firms. However, previous research has shown that their success is far from guaranteed (Madhok & Tallman 1998), therefore calling for dedicated network management activities to mitigate the inherent complexities of inter-organizational linkages (Poulymenakou & Klein 2006).

> *"Top-performing companies distinguish themselves from the ordinary by their ability to anticipate where in the chain lucrative opportunities are likely to arise and to invest in the capabilities and relationships to exploit them…" (Fine 1998)*

An important premise in effective management of these value networks is the ability to sense where value lies within the network and better coordination of activities in order to appropriate the value. Information sharing can help organizations in anticipating opportunities within the network (Bovet & Frentzel, 1999; Samaddar et al. 2006) and react to such opportunities in a timely manner. For example, sharing information about the actual sales data at retail outlets allows manufacturers to better understand demand variations and thereby optimize their production capacities (Lee et al. 1997). Buffers are common across any value network to deal with the uncertainties associated with demand and supply. An effective value network can allow firms to substitute information for these buffers and thereby increase agility in the network which can lead to reduction of inventory cost, as well as stock-out costs, or costs of marking down products.

Recognizing the important role of information sharing in improved supply chain and network performance, firms have been adopting information technology (IT) innovations to integrate and improve their supply chain processes (Christiaanse 2005). In spite of access to advanced IT solutions,

[1] The terms value networks, supply network and supplier value networks are used interchangeably in this paper, and are used to refer to vertically and horizontally integrated networks of firms for the purpose of procuring raw materials and services that are transformed into end-products for customers.

supply chain networks across different industries and sectors suffer from poor and inexact information, delayed sharing of information, and lack of information where and when it is needed most (Straub et al. 2004). This is primarily because of the lack of guiding theories for such initiatives towards formation of supply networks and adoption of IT solutions to support such networks (Straub et al. 2004).

In order to be able to realize cost reductions and other operational and strategic efficiencies within the value network, members should have access to timely, relevant and accurate information (Rai et al. 2006). Visibility of relevant information or transparency in the network can enable members to execute appropriate strategies and respond to market fluctuations and other competitive, economic and technological challenges. Our objective in this research is to provide a more nuanced understanding of information visibility by conceptualizing *value network transparency* as a characteristic of the network that implies the access to relevant and timely information that assist in network-specific decisions for the overall management of the network.

We postulate that value network transparency facilitates the management of supply networks and can thereby lead to agile and high performing networks; and identify the different dimensions of value network transparency. We use relational governance (Dyer & Singh 1998) as the overarching theoretical perspective and draw from previous research on inter-organizational governance, supply chain management and inter-organizational information systems to identify the different factors that promote value network transparency and theorize regarding their relationship with network performance. We further discuss the implications of differences in situational factors such as product type on the role of transparency in network performance.

The remaining sections are organized as follows: section 2 outlines the motivation for this research by identifying the gaps in existing literature; section 3 defines value network transparency and its different dimensions. Section 4 identifies the different determinants of value network transparency and the performance implications of such transparency, and proposes the research model by articulating the relationship between the various factors. We conclude with a discussion of contributions and the implications for future research.

2 MOTIVATION

Given the inherent complexity of inter-organizational exchange relationships, our research is motivated by the question: *how should supplier networks be governed for the appropriation of higher value and performance gains from such networks*? Two important aspects of analyzing a firm's value network are the sources of value and the coordination mechanisms used to manage and appropriate value from the network (Simatupang et al. 2002). The ability to identify where value resides within the network is an important ability and the first step towards realizing higher performance benefits. Further, effective network management through appropriate coordination and governance mechanisms will facilitate translating such value into actual performance gains (Harland & Knight 2001).

Information sharing in supply networks has been identified as an important means of managing exchange relationships for value appropriation (Bovet & Frentzel, 1999; Lee et al. 1997; Samaddar et al. 2006; Klein et al. 2007; Rai et al. 2006). Accordingly, information systems (IS) researchers have focused on analyzing the use of information technology to integrate members in a supply networks. Such research is guided by the reasoning that the ability to easily, efficiently and economically access information outside a focal firm's boundaries can generate efficiencies for members of an exchange relationship (Klein et al. 2007). IS researchers have focused on analyzing the nature of IT used in exchange relationships, and how information sharing can help in achieving supply chain process integration for performance gains (Rai et al. 2006; Subramani 2004); how capabilities of IS applications deployed in inter-firm relationships can help in performance gains (Saraf et al. 2007); and how the use of standardized IT applications can help firms in overcoming knowledge exchange barriers in inter-firm relationships and subsequently attain better performance (Malhotra et al. 2007).

The growing body of research has therefore highlighted the role of information sharing with IT applications and capabilities being identified as the means of achieving such shared information. On the other hand, significant research in the domain of inter-organizational networks and alliances have focused on the effectiveness of network management strategies as a primary means of realizing performance benefits from value networks. Accordingly, findings from the strategic management literature indicate that formulation of appropriate strategies and mechanisms for governance of inter-firm relationships will have positive implications of network performance. Williamson's (1983) transaction cost theory has often been used as the guiding principle to delineate different structural choices in alliances and networks (e.g., Parkhe 1993), and for identifying factors that lead to different coordination mechanisms, such as markets or hierarchical structures (Gulati & Singh 1998) and governance choices, such as contractual or arm's length governance versus relational governance (Williamson 1993; Dyer & Singh 1998).

This stream of research is often based on the assumption that network efficiencies are a result of reduced cost of transacting, and choice of governance structures and coordination mechanisms is determined by a consideration towards reducing transaction costs. Other theoretical perspectives such as Giddens' structuration theory (Giddens 1984) has been used to explain how structures and governance mechanisms evolve over time and get established in inter-firm networks (Sydow & Windeler 1998), and the notion of structural embeddedness has been used to outline mechanisms of network governance for higher performance in inter-organizational networks (Jones et al. 1997).

Therefore, while the network value appropriation concerns are addressed within the IS literature as a information sharing problem, the strategic management literature addresses it as a governance and coordination problem. Recognizing the importance of both information sharing and the resultant visibility from such sharing of information, and appropriate governance strategies and mechanisms for achieving information sharing and subsequent value gains, we propose value network transparency as a network capability that emerges based on appropriate choice of governance mechanisms, and subsequently results in higher performance gains for the supplier network. Given that both information sharing and performance gains are fundamental considerations in supplier relationships, we combine two seemingly divergent streams of literature by conceptualizing value network transparency as a central concept in supplier networks for more effective management and performance gain in the overall network.

3 VALUE NETWORK TRANSPARENCY

Access to information that is relevant, timely and accurate can enable network members to react in a timely manner to various events concerning the network, and generate efficiencies for participants in exchange relationships. Such information can be considered to be of a higher quality (Wang & Strong 1996), and therefore address the needs of the member firms. Buyers can tap into such information to streamline processes, develop value-added products and services, and strengthen customer ties (Gulati & Kletter 2005), while suppliers can pool information about buyer requirements across time, channels and services to globally optimize plans and process execution (Lewis et al. 2007). We define value network transparency as the visibility of relevant information in a timely manner to members of the network (buyers, suppliers or other trading partners involved in an exchange relationship).

The extent to which information is available within the network will determine the transparency in the network. There can be different levels of transparency depending on the kind of information shared (Lamming et al. 2001). While significant research has been devoted in understanding the quality of information that a system can provide (e.g., Lee et al. 2002), there has been less research directed towards assessing the quality and completeness of information that is shared among network members (Straub et al. 2002).

We define transparency as the access to relevant, timely and accurate information within the supply network. Therefore, it is important to understand what these translate to in terms of information sharing or exchange among network members. In order to identify the different dimensions of value

network transparency, we start by asking three important questions. First, *what and how much information is being shared among the trading partners?* Second, *does the shared information allow the trading partners to take appropriate decisions and actions?* Third, *is the information shared in real-time or in a time-delayed manner?* Drawing from these fundamental questions, we conceptualize transparency in terms of three dimensions namely, information shared, information relevancy and information latency. Each of these dimensions of transparency is discussed in detail below.

3.1 Information Shared

Information shared refers to the different categories of supply and demand data that can be shared within a buyer-supplier relationship. Exchanging information on forecasting, planning, product design and production scheduling reduces information asymmetry within the network, and can help in organizations to execute activities and processes in a more efficient manner (Wang & Wei 2007). In this research, information shared is conceptualized as the breadth of the information. In the context of buyer-supplier relationships, this dimension of transparency will therefore comprise information on planning, forecasting, buy / supply information and manufacturing information (Wang & Wei 2007).

3.2 Information Relevancy

Sharing information provides the visibility to optimize supply chain performance (Simatupang et al. 2002). The information that is shared can be of transactional, operational or strategic nature (Rai et al. 2007). Transactional information constitutes the most common form of information sharing among supply chains members, and it often necessary for the completion of specific processes. For instance, in order to complete a purchase order or a shipment, it is necessary to share information regarding order quantity, unit price, delivery date, etc. At the same time, certain information sharing can transcend individual transactions and be oriented towards creating a deeper understanding of the business model of trading partners. Such information is characterized as strategic or tactical information.

When a supplier receives order information from a buyer, the information is sufficient for them to execute the activity of fulfilling the order. If in addition to the order information, they also receive productions plans and demand schedules, they can form a higher order understanding of the market scenario and business details for the buyer and plan and optimize their own production facilities accordingly. Firms that go beyond sharing purely transactional information to sharing information that facilitate collaborative actions can create higher value (Klein & Rai 2009; Wang & Wei 2007). Therefore, our conceptualization of information relevancy refers to the availability of information that assists in a more optimized and synchronized execution of activities by trading partners.

3.3 Information Latency

Information sharing among business partners could occur in real time or in a time-delayed fashion. With real time information sharing of events that impact demand fulfillment occur, relevant information is shared with near zero latency. For example, orders booked could be communicated immediately after the event. Similarly, delays in shipments could be communicated in real time to enable trading partners to respond immediately. Further, tracking and identification technologies, such as bar-codes and radio frequency identification (RFID) can be used for the real time capturing and transmission of point-of-sale information, which can help planning in-stock replenishment schedules to avoid stock-out costs.

Organizations might choose to batch information and communicate with trading partners at regular frequency for several reasons. Considerations such as transaction processing efficiency, batching frequency of business processes such as order processing, and the cost of sharing setting up systems for real time information sharing might lead firms to share information in a time-delayed manner. While not all information shared among trading partners need to be communicated in real time, our

conceptualization of this dimension of transparency focuses on whether the value network has the capability to exchange those information that need to be exchanged with zero latency.

4 RESEARCH MODEL SYNTHESIS

Inter-organizational relationships are governed using different governance mechanisms. These include the use of contractual safeguards to minimize opportunistic behaviours or mutual trust-based governance. Relational governance is a particular form of governance that can be effectively used in inter-firm relationships for the generation of relational rents (Dyer and Singh 1998). Since supplier value networks are formed primarily with the expectation of super-normal performance gains owing to the relationship among various trading partners, these performance gains can be visualized as relational rents, and relational governance can be considered as a viable alternative for governing such value networks.

Further, it has been highlighted that although the importance of information sharing in alliances and networks is highly recognized, some of the most significant factors that impede firms from sharing information and taking collaborative actions are exploitation of information asymmetry and trust and opportunism related issues (Christiaanse 2005). Since relational governance is an alternative to other forms of arms-length governance that encourage lack of trust among organizations, we use relational governance as the over-arching theoretical perspective to further analyze value network transparency and the factors that determine it.

For the relationship partners to be able to realize relational rents, factors like relation-specific assets, complementary resources and capabilities, effective governances and knowledge-sharing routines need to be present within the relationship (Dyer and Singh 1998). We postulate that value network transparency is an emergent property of relational governance in the network, which influences the realization of relational rents in the form of improved strategic and operational performance. Therefore, we analyze both the determinants of value network transparency and the consequences of having such transparency in the network.

4.1 Antecedents of Value Network Transparency

Identifying a dyad or network as an increasingly important unit of analysis, previous research has examined the sources of relational rents in such inter-firm networks. However, the underlying mechanism through which these relational rents get generated lack clear understanding. Based on the formulation of value network transparency as an emergent property of the network, we examine different factors that affect value network transparency. In order to have value network transparency, the parties involved in the relationship should have both – the motivation to achieve transparency and the capabilities to achieve it. Therefore, we analyse the antecedents of value network transparency by either classifying them as motivating factors or as required capabilities.

Relation-specific Assets: The relational view of inter-organizational relationships suggest that resources through which a firm can realize competitive advantage lie not within the boundaries of individual firms, but extend across individual boundaries and fall under the purview of the relationship (dyad or network). To create such resources, firms have to invest into relation-specific assets in order to realize competitive advantages attributable to the relationship (Amit & Shoemaker 1993; Dyer & Singh 1998). Investment into relation-specific assets increases the stake that each party have in the relationship, therefore their commitments towards the relationship. Accordingly, relation-specific assets not only reduce the risks of opportunistic behaviour by individual firms, but also encourage member firms to make the relationship successful. Investments in relation-specific assets have been found to be positively related to performance in various forms of inter-organizational relationships such as strategic alliances (Parkhe 1993), buyer-supplier relationships (Asanuma 1989; Dyer 1996) and among channel partners (Saraf et al. 2007).

When firms invest towards the creation of such resources, they effectively create a mutual reliance relationship by enhancing credible commitments (Williamson 1983). Such joint investments would therefore provide the incentives to develop relational norms among firms (Bercovitz et al. 2006), and make firms more eager to take the necessary measures that make the relationship successful. Research in inter-organizational relationships has already recognized the importance of information sharing, and it has been identified as a particularly important factor in the management of buyer-supplier relationships (Lee et al. 1997).

Therefore, value network transparency can facilitate effective management of the overall network or individual relationships within the network, and constitute an important step towards realizing the performance gains of networks that have invested in relational assets. We postulate that value network transparency will mediate the relationship between investment in relational assets and performance benefits realized from such networks. Accordingly firms that have invested in relation-specific assets will be more eager to achieve value network transparency.

> *Proposition 1: Investments in relation-specific assets are positively associated with Value Network Transparency.*

Knowledge-sharing Routines: Previous research has suggested that alliance partners are the best source of new ideas and information that result in performance enhancement, and firms that are not able to create such learning networks through effective information exchange mechanisms face competitive disadvantages (Powell 1996). Learning is however contingent on the exchange environment and mechanisms that exist between alliance and network partners (Kale et al. 2000). A firm is able to learn from its partners when the level or transparency or openness between them is high (Hamel 1991; Doz & Hamel 1998).

Knowledge-sharing routines are defined as regular patterns of inter-firm interaction that permit the transfer, recombination or creation of specialized network knowledge (Dyer & Singh 1998; Grant 1996). Superior knowledge-sharing mechanisms between buyers, suppliers and manufacturers are able to out-innovate and out-perform less effective knowledge-sharing routines (Von Hippel 1988). For instance, in the automotive industry, it has been demonstrated that Toyota and its suppliers were able to achieve higher performance compared to their counterparts in the US automotive industry by setting up effective knowledge sharing routines within its supplier network (Dyer & Nobeoka 2000; Dyer & Hatch 2006).

By creating knowledge sharing routines in the network, member firms become not only aware of the need for information exchange for these routines to function properly, but also of the kind of information that needs to be shared within the network. Knowledge sharing routines facilitate members to achieve learning from a relationship. Learning from a relationship can be of three types – the kind of learning that helps a firm in accessing or internalizing critical information or capability from its partner, the kind of learning where partners learn about each other's intended and emergent goals with the purpose of managing the collaboration process and working better with each other, and finally the kind of learning that enhances the alliance capability of individual firms (Kale et al. 2000). The knowledge sharing routines used in an alliance or network relationship will depend on the kind of learning that the firms want to achieve, and will in turn determine the nature of information that will be or need to be shared among the firms.

Value network transparency can be considered as the means of ensuring that firms are able to successfully learn from a relationship and that the knowledge sharing routines that were set up can be successfully executed. For instance, a scenario where firms expect to learn about each other's intended goals and targets with the purpose of better managing the collaboration process is likely to have means of sharing information that are of a more strategic nature – such as demand forecasts of production schedules. Similarly, sharing of process information will be encouraged when firms are looking towards internalizing industry or domain-specific best practices.

Therefore, like investment in relational assets, knowledge sharing routines can be viewed as a factor that motivates or encourages the members of the network to share the relevant information. Value network transparency can be viewed as a construct that mediates the relationship between knowledge sharing routine and performance in supply chains and networks.

> *Proposition 2: Knowledge sharing routines are positively associated with Value Network Transparency.*

Complementary Resources and Capabilities: Complementary resources among alliance members are widely discussed as a key factor that determines returns from such alliances (e.g., Hamel & Prahalad 1994; Shan & Hamilton 1991). Complementary resources are defined as distinctive resources of alliance partners that when collectively deployed can generate higher returns than the sum of returns generated by their individual deployments (Dyer & Singh 1998). These are resources that are often difficult to imitate or procure from the market, and there are various mechanisms through which complementary resources facilitate the generation of super-normal value from networks.

One of the major challenges faced by organizations attempting to generate higher value in networks or alliances is that of identifying such complementary resources and recognizing the value of deploying those resources in a collective manner. In order to be able to identify and evaluate partners with complementary resources, the firm needs to have access to accurate and timely information regarding partners (Dyer & Singh 1998). Therefore, a network where firms share information among each other will make it possible to recognize possible mutual resources that can complement each other and deploy them for appropriation of higher value from such network. Accordingly, value network transparency is a key step towards achieving higher value through the deployment of complementary resources.

In addition to the role played by value network transparency in the recognition of critical and inimitable complementary resources, there is another dimension to the relationship between value network transparency and complementary capabilities, in particular information technology (IT) capabilities within the network. Since the 1980s, IT has been considered a major driver of competition among supply chains and industry networks (Christiaanse 2005). Currently, technological advancements have made it possible to integrate the IT infrastructures in a more network-centred collaborative manner. Such IT capabilities can facilitate the realization of higher returns by enabling companies to share relevant and accurate information in a timely manner.

It has been proposed that the existence of rich and sophisticated channels of communication among partners in an inter-firm network will determine the extent to which they are able to go beyond the exchange of mere operational data, and attain the exchange of more strategic and collaborative information (Gupta & Govindarajan 2000). Network partners possessing such IT capabilities are able to achieve higher visibility to each other's activities and processes. Therefore, complementary resources of a strategic nature will form the motivation of firms to achieve value network transparency, while complementary capabilities, such as sophisticated IT capabilities act more as a pre-requisite for achieving value network transparency. Therefore, complementary resources and capabilities will be positively associated with value network transparency and subsequently higher returns from inter-firm relationships.

> *Proposition 3: Complementary resources and capabilities are positively associated with Value Network Transparency.*

Effective Governance: Governance measures affect the willingness of network members to engage in value creating initiatives (Dyer & Singh 1998). Governance mechanisms can be differentiated between third-party enforced governance (such as legal contracts) and self-enforcing agreements where no external party intervenes to determine whether a violation of norms, rules or acceptable behaviour has

taken place. Although third-party governance through legally-enforceable contracts can act as complements to self-enforcing agreements among firms (Poppo & Zenger 2002), from a transaction cost economics perspective, third-party enforcement is the suggested means of governance under high concerns regarding opportunistic behaviour among members (Kale et al. 2000). Self-enforcing agreements on the other hand are derived from the perspective of trust and embeddedness of relationships, and are based on the assumption that opportunism can be avoided in a trusting environment where firms are more likely to act in a collaborative manner (Jones et al 1997).

Self-enforcing agreements can be of a more formal nature – such as through joint investments in relational assets, which increase the stake of each party in the relationship, and of a more informal nature – such as those based on goodwill, trust and reputation (Dyer & Singh 1998). Joint investments in relationship-specific infrastructure (such as IT infrastructure and capabilities for the network, or shared physical infrastructure) and setting up collaborative business processes and mechanisms are means of achieving self-enforcing agreements of the formal nature. Informal agreements are achieved based on mutual trust and cooperation, and by having incentives that are aligned among the relationship members. Madhok (1995) provides a slightly different interpretation of self-enforcing governance, which he refers to as trust, and differentiates between structural component of trust that is fostered through mutual hostage situation, and a behavioural component that refers to the confidence that partners have in each other's reliability and integrity. While the structural component of trust is more similar to self-enforcing agreements that are achieved through joint investments into relational assets, the behavioural component enhances the willingness among partners to achieve information visibility and transparency in the network.

Governance of inter-organizational relationships involves more than just formal contracts, and typically emerges through repeated exchanges embedded in social relationships (Poppo & Zenger 2002). Therefore, the governance measures reflect the values and agreed-upon processes that are commonly found in social relationships (Heide & John 1992; Macneil 1980). This is in agreement with the notion of trust and self-enforcing agreements that form the basis of relational governance measures.

Self-enforcing agreements of the formal nature can serve the purpose of both acting as motivating factors for firms to share information with each other, and at the same time give them the capability to do so when they incorporate investments into relationship-specific IT infrastructure. Where partners are confident about each others' integrity and reliability, competitive impediments to information and knowledge exchange such as partner rivalries, and protective behaviours due to the fear of losing ownership and superiority are reduced (Simonin 1999). This results in a more cohesive environment, which is positively associated with assisting each other through information exchange (Reagans & McEvily 2003). Relationships based on mutual trust will naturally tend to have an environment that is conducive towards sharing information not only of the transactional nature, but higher order information that allow for synchronization and optimization across the supply value chain. Therefore, governance measures will be positively associated with value network transparency within inter-firm relationships.

> *Proposition 4: Effective governance measures are positively associated with Value Network Transparency.*

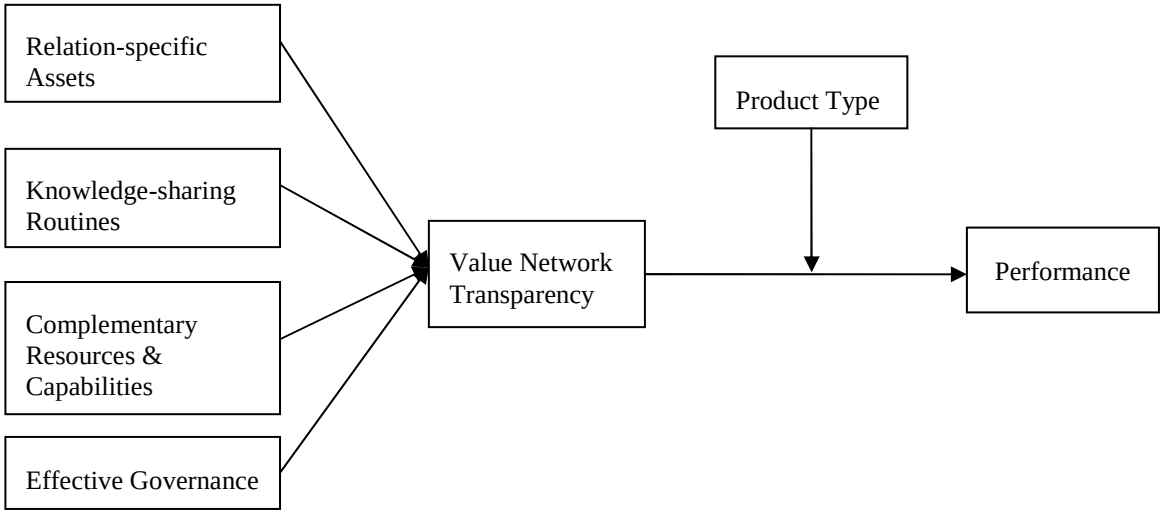

Figure 1. Research Model for Value Network Transparency

4.2 Value Network Transparency and Performance

Supplier value networks offer opportunities to gain improved performance, and inter-firm information sharing provides the ability for anticipating such opportunities (Samaddar et al. 2006). The relationship between information sharing and performance in supply networks has been previously discussed (for example, Cachon & Fisher 1998; Sahin & Robinson 2002; Lee et al. 1997). Although, the general understanding is that the quantity and frequency of information sharing determines performance, there is much ambiguity as to how information sharing leads to performance, and more importantly the performance of the network as a whole rather than the performance of individual firms. Accordingly, there have been efforts to theorize and operationalize performance at network and dyad levels rather than at the individual firm level (Straub et al. 2004).

From a focal firm's perspective, performance gains have been characterized as operational efficiency gain, revenue growth and better management of relationships with its customers (Rai et al. 2006). Operational efficiency gains are defined as the degree to which a firm is better than its competitors in its responsiveness and productivity gains. Revenue growths are measured as the extent to which a firm's increase in revenues from current and new products and markets is higher than that of its competitors. Improved customer relationship management reflects the degree to which the firm's relationship with its customers and information regarding their preferences are better than their competitors.

Performance gains at the network level can be thought of as the increased aggregate performance of an entire set of networked organizations or the entire system of firms compared to other networks (Groves & Valsamakis 1998; Straub et al. 2004). For the supplier value network to be able to function effectively there should be symmetry in the performance gains realized by each member of the networked organizations. Such performance gains can incorporate return on investment of the network as a whole, inventory turnover of the network as a whole, working capital efficiency and operating margins (Straub et al 2004).

Value network transparency will have positive implications for performance, both at the firm level, as well as for the network as a whole. Having access to relevant transactional, operational and strategic information in a timely manner will allow network members to improve forecasts, synchronize production and delivery, coordinate inventory-related decisions and develop a shared understanding of

performance bottlenecks (Lee & Whang 2000; Simchi-Levi et al. 2003). At the firm level, this will improve operational performance by reducing inventory costs, enhance working capital utilization and inventory turnover cycles (Rai et al. 2006). Value network transparency reduces information asymmetry among different members of the network by ensuring that all parties have access to the relevant information that helps them in coordinating their activities and taking mutually synchronized decisions. Therefore, asymmetric performance gains are reduced, and the operational performance gains discussed above are not just realized by only selected firms within the network, but by the network as a whole.

Value network transparency will facilitate collaborative forecasting through more precise demand estimation and better alignment of supply with demand. This will help firms in improving customer service and in establishing stronger bonds with their customers by reducing stock-outs through timely replenishments. Such performance gains will not only be restricted to each individual firm, but will also translate into gains for other members of the networks, who will be able to synchronize their production and delivery cycles based on a better alignment between demand and supply. By having more information regarding customer preferences, the network as a whole will be in a better position to not only generate increased revenue from existing products, but also launch new products and also realize performance gains in both existing and new markets (Rai et al. 2006).

Proposition 5: Value Network Transparency is positively associated with the Performance of a focal firm

Proposition 6: Value Network Transparency is positively associated with Performance gains of the network as a whole.

Moderating Role of Product Type

Despite the pre-dominant expectation regarding a positive relationship between information sharing and overall performance in supply networks, there is a need to examine the implications of situational factors such as the industry sector or transaction type (Hsu et al. 2008), the effects of environmental uncertainty (Milliken 1987), or the need to customize supply chains and production plans according to the type of product or service (Fisher 1997; Li & o'Brien 2001; Kaipia & Holmström 2007).

The nature of the product can determine several factors that play a significant role in determining how the supply chain is designed and managed (Fisher 1997; Lee 2002). For instance, certain products are seasonal and therefore may have more predictable demand fluctuations over time, while on the other hand certain products maybe made up of components that are difficult to source – and therefore have supply chains characterized by supply uncertainties. Products can also be characterized by differences in life-cycles, and the rate of technological change. Electronics products are such an example where the technology advances extremely fast making products outdated or obsolete at a very fast rate. In the apparel industry, the supply of high fashion products can be managed by a higher capability to spot trends and predict demands (Caro & Gallien 2010), and quick response capabilities to such trends (Cachon & Swinney 2010). On the other hand, consumer goods such as the like of toothpastes are mostly stable in terms of technological changes, demand fluctuations and have long product life cycles.

Fisher (1997) distinguishes between innovative and functional products, calling for different supply chain strategies for each of these product types. While functional products can benefit from a supply chain that is geared towards achieving physical efficiencies, innovative products need a market responsive supply chain process. Lee (2002) proposes supply chain management strategies by further distinguishing both functional and innovative products based on high or stable demand fluctuations and high or low supply variations.

Products that have short lifecycles and are characterized by rapid technological advancements need to have a more efficient collaborative planning process that can help them in achieving a responsive value network. The need for real time access to information regarding changes in demand will be

higher for such products. Also, the supply networks for such products should have the ability to communicate strategic and tactical information to all members of the network so that they can synchronize their activities and processes in order to meet the challenges of very small response times and shortening product lifecycles. Therefore, value network transparency will have a stronger impact on the performance of supply networks for such products, compared to regular functional products that are characterized by relatively steady demand and supply schedules. Accordingly, the relationship between value network transparency and performance will be moderated by the nature of the product.

> *Proposition 7: The nature of the product will moderate the relationship between value network transparency and performance.*

Table 1 outlines the different variables that are of interest in the theoretical model for value network transparency and the relationship among them. Antecedents of value network transparency are further classified as either motivators of transparency or facilitators of transparency.

Value Network Transparency Information Shared Information Relevancy Information Latency		**Performance Gains** Network Performance Firm Level Performance
Motivators	**Facilitators**	**Moderator**
Relation-specific Assets Knowledge Sharing Routines Complementary Resources Self-enforcing Agreements	Relation-specific IT Assets Complementary IT Capabilities	Product Type • Innovative / Functional Products • High demand fluctuations • Supply Variations • Product Lifecycles

Table 1. Variables of Interest in Assessing Value Network Transparency

5 DISCUSSION AND IMPLICATIONS FOR FUTURE RESEARCH

With supply networks emerging as the chosen form of coordination for the sourcing of raw materials and services across different industry sectors, there is a need to understand more effective ways to manage such networks. While it is almost unanimously agreed upon that information sharing plays an important role in the management of such supply networks for value appropriation, there exists ambiguity over the kind of information that can be shared, ought to be shared and is actually shared in such inter-firm relationships. Moreover, there are conflicting views on what motivates organizations to share such information in the first place, since on one hand, access to relevant strategic information is viewed as a source of competitive advantage and can increase the risks of misappropriation, and on the other hand, cooperative norms among firms might engender a higher willingness to share information.

By proposing value network transparency as a concept that captures the notion of availability of relevant, accurate and timely information within the network, this research attempts to address the above issues in the context of supplier value networks. It has been suggested that information sharing in buyer supplier dyads should go beyond the sharing of primarily transactional information to the sharing of strategic information (Klein & Rai 2009). By enumerating different dimensions of transparency, this research goes beyond information sharing and provides a more holistic view of information visibility or transparency within supplier networks. Different networks can achieve different degrees of transparency depending on the extent to which they share information along each dimensions of value network transparency.

Information systems research literature on supply chains and networks have often focused on the role of information technology applications, and how such technologies can be used and combined in inter-organizational settings for achieving information integration and/or process integration. However, despite significant research efforts, and the availability of sophisticated technological solutions, supply networks are complicated inter-organizational structures that face problems in value appropriation and in attaining enhanced performance. Also, despite having advanced technological capabilities, information sharing within the value network may often remain restricted to the sharing of transactional information, rather than tactical or strategic information. Therefore, in addition to having the technological capability that allows organizations to achieve value network transparency, there is a need to understand the motivational aspects of sharing information with partner firms (Christiaanse 2005; Klein & Rai 2009).

Using the relational governance perspective (Dyer & Singh 1998) on the management of inter-firm relationships within supplier networks, we identify factors that motivate organizations to achieve value network transparency, as well as factors that enhance their capability to achieve transparency. Therefore, while inter-organizational information systems are likely to bestow the capability to share relevant accurate and real time information, setting up of knowledge sharing routines and governance measures based on trust and investments in relation-specific assets will enhance individual firm's motivation in sharing the information that allows the network to take coordinated and synchronized actions for the overall efficiency of the network.

We propose value network transparency as an emergent property of the network that mediates the relationship between the different governance measures and performance gains. There has been significant discourse on the use or relational governance to foster trust and collaboration in inter-organizational supplier networks as means of managing transaction costs by minimizing the need for contractual safeguards. Value network transparency can be viewed as a network capability that emerges from the use of relational governance measures. This capability will in turn enable firms to take timely and strategic actions that competitive and market dynamics call for. Therefore, value network transparency explains the process through which supply networks are able to achieve higher performance, both for individual firms and the network as a whole.

This paper makes theoretical contributions to current research on supply networks by identifying value network transparency and the key parameters that motivate and enable it. The arguments presented in this paper have significance for supply chain and network practitioners as they develop strategies for managing and governing their supply networks. Successful management endeavours can be realized for fostering a trusting environment of social relationships among member firms in conjunction with building IT and other strategic capabilities that promote information sharing and the heightened performance that is symmetrically distributed among the firms.

Future research should be focused towards designing and conducting empirical studies to test and build on the propositions developed in this paper. The propositions can be more thoroughly examined by studying supplier networks across different industry sectors and catering to different end products. In-depth case studies of specific supply networks should be conducted to assess the extent to which relational governance mechanisms are used within such networks and the role they play in facilitating value network transparency. Further, large-scale surveys need to be conducted to collect information regarding the how networks are governed, not just from an individual firm as a respondent, but from multiple members within the network, such that questions regarding value network transparency and performance can be answered in a more comprehensive manner. The goal should be to select the network as a unit of analysis rather than individual firms. The findings from such research can be used by firms to redesign networks that are not particularly effective and attempt to realize major improvements in performance.

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